

Appln No. 10/621,988
Amdt date July 30, 2008
Reply to Office action of April 30, 2008

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Please amend claim 1, cancel claims 10, 11 and 16, and add new claims 46-48.

1. (Currently Amended) A catheter comprising:

an elongated catheter body having proximal and distal ends and an irrigation lumen extending therethrough;

a tip electrode at the distal end of the catheter body and comprising an irrigation passage having at least three radially extending irrigation branches;

an infusion tube extending through the irrigation lumen in the catheter body into the irrigation passage in the tip electrode, the infusion tube being in fluid communication with the radially extending irrigation branches in the tip electrode;

an ultrasound transducer mounted at or near the distal end of the catheter body on a surface of the tip electrode, the transducer having a front surface and an opposing back surface, wherein the back surface of the transducer is mounted to the distal end of the catheter body such that the transducer is positioned to transmit ultrasound energy toward tissue facing the front surface but not toward tissue facing the back surface;

a sensor mounted within the catheter near the ultrasound transducer for sensing a location and an orientation of the ultrasound transducer within a patient, and;

a means for deflecting the distal end of the catheter comprising:

a control handle mounted at the proximal end of the catheter body; and

a deflection wire extending through the catheter body, the deflection wire having a distal end fixedly attached near the catheter body's distal end and a proximal end anchored to a mechanism in the control handle that facilitates longitudinal movement of the deflection wire relative to the catheter body, wherein the deflection wire is anchored at a position that is about 70° to 120° relative to the direction that energy is emitted from the transducer to thereby deflect

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~~the distal end of the catheter in a direction generally transverse to the direction that energy is emitted from the transducer.~~

2. (Original) The catheter of claim 1, wherein the transducer is generally flat.
3. (Original) The catheter of claim 1, wherein the transducer is generally rectangular.
4. (Original) The catheter of claim 1, wherein the transducer has a length ranging from about 2 mm to about 10 mm.
5. (Original) The catheter of claim 1, wherein the transducer has a length ranging from about 5 mm to about 10 mm.
6. (Original) The catheter of claim 1, wherein the sensor is an electromagnetic location sensor.
7. (Original) The catheter of claim 1, wherein the sensor is mounted within 10 mm of the transducer.
8. (Original) The catheter of claim 1, wherein the sensor is mounted within 5 mm of the transducer.
9. (Original) The catheter of claim 1, wherein the sensor is mounted under the transducer.
10. (Canceled).

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11. (Canceled).

12. (Canceled).

13. (Canceled).

14. (Canceled).

15. (Original) The catheter of claim 13, wherein the deflection wire is anchored at a position that is about 90° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally perpendicular to the direction that energy is emitted from the transducer.

16. (Canceled).

17. (Withdrawn) A catheter comprising:

an elongated catheter body having proximal and distal ends;

a tip electrode mounted at the distal end of the catheter body, the tip electrode having an exposed electrode surface and a transducer mounting surface opposite the exposed electrode surface; and

an ultrasound transducer mounted on the transducer mounting surface of the tip electrode.

18. (Withdrawn) The catheter of claim 17, wherein the transducer has a front surface and an opposing back surface that faces the tip electrode, wherein the transducer is positioned to transmit ultrasound energy toward tissue facing the front surface but not toward tissue facing the back surface.

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19. (Withdrawn) The catheter of claim 18, wherein the exposed surface of the tip electrode has a length ranging from about 2 mm to about 10 mm.

20. (Withdrawn) The catheter of claim 18, wherein the exposed surface of the tip electrode has a length ranging from about 6 mm to about 8 mm.

21. (Withdrawn) The catheter of claim 17, wherein the tip electrode has an exposed surface and a stem having a diameter less than the diameter of the exposed surface, wherein the transducer is mounted on a surface of the exposed surface.

22. (Withdrawn) The catheter of claim 17, further comprising a sensor mounted within the catheter body near the ultrasound transducer for sensing a location and an orientation of the ultrasound transducer within a patient.

23. (Withdrawn) The catheter of claim 22, wherein the sensor is an electromagnetic location sensor.

24. (Withdrawn) The catheter of claim 17, wherein the transducer is generally flat.

25. (Withdrawn) The catheter of claim 17, wherein the transducer is generally rectangular.

26. (Withdrawn) The catheter of claim 17, wherein the transducer has a length ranging from about 2 mm to about 10 mm.

27. (Withdrawn) The catheter of claim 17, wherein the transducer has a length ranging from about 5 mm to about 10 mm.

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28. (Withdrawn) The catheter of claim 17, further comprising means for deflecting the distal end of the catheter.

29. (Withdrawn) The catheter of claim 28, wherein the means for deflecting the distal end of the catheter comprises:

a control handle mounted at the proximal end of the catheter body; and

a deflection wire extending through the catheter body, the deflection wire having a distal end fixedly attached near the catheter body's distal end and a proximal end anchored to a mechanism in the control handle that facilitates longitudinal movement of the deflection wire relative to the catheter body.

30. (Withdrawn) The catheter of claim 29, wherein the deflection wire is anchored at a position that is about 70° to 120° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally transverse to the direction that energy is emitted from the transducer.

31. (Withdrawn) The catheter of claim 29, wherein the deflection wire is anchored at a position that is about 90° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally perpendicular to the direction that energy is emitted from the transducer.

32. (Withdrawn) The catheter of claim 17, further comprising an irrigation passage extending through at least a portion of the catheter body and having an open distal end near the transducer to introduce fluid to contact tissue being ablated with the transducer.

33. (Withdrawn) The catheter of claim 32, wherein the irrigation passage extends through the tip electrode.

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34. (Withdrawn) A catheter comprising:

an elongated catheter body having proximal and distal ends;

an ultrasound transducer mounted at or near the distal end of the catheter body, the transducer having a front surface and an opposing back surface, wherein the transducer is positioned to transmit ultrasound energy toward tissue facing the front surface but not toward tissue facing the back surface;

a control handle mounted at the proximal end of the catheter body; and

a deflection wire extending through the catheter body, the deflection wire having a distal end fixedly attached near the catheter body's distal end and a proximal end anchored to a mechanism in the control handle that facilitates longitudinal movement of the deflection wire relative to the catheter body, wherein the deflection wire is anchored at a position that is about 70° to 120° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally transverse to the direction that energy is emitted from the transducer.

35. (Withdrawn) The catheter of claim 34, wherein the deflection wire is anchored at a position that is about 90° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally perpendicular to the direction that energy is emitted from the transducer.

36. (Withdrawn) A method for epicardial ablation in a patient comprising:

introducing into the pericardium of a patient a distal end of a catheter comprising an elongated tubular body with a transducer mounted at or near the distal end of the tubular body, the transducer having a front surface and an opposing back surface, wherein the transducer is positioned to transmit ultrasound energy toward tissue facing the front surface but not toward tissue facing the back surface;

positioning the transducer's front surface so that it generally faces tissue to be ablated; and

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ablating the tissue to be ablated with ultrasound energy generated by the transducer.

37. (Withdrawn) The method of claim 36, further comprising determining the position and orientation of the transducer within the pericardium using a sensor mounted within the catheter near the ultrasound transducer.

38. (Withdrawn) The method of claim 36, further comprising deflecting the distal end of the catheter before or during the positioning of the transducer's front surface so that it generally faces tissue to be ablated.

39. (Withdrawn) The method of claim 38, wherein the distal end of the catheter is deflected in a direction generally transverse to the direction that energy is emitted from the transducer.

40. (Withdrawn) The method of claim 38, wherein the distal end of the catheter is deflected in a direction generally perpendicular to the direction that energy is emitted from the transducer.

41. (Withdrawn) The method of claim 38, wherein deflection is accomplished with:
a control handle mounted at the proximal end of the catheter body; and
a deflection wire extending through the catheter body, the deflection wire having a distal end fixedly attached near the catheter body's distal end and a proximal end anchored to a mechanism in the control handle that facilitates longitudinal movement of the deflection wire relative to the catheter body, wherein the deflection wire is anchored at a position that is about 70° to 120° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally transverse to the direction that energy is emitted from the transducer.

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42. (Withdrawn) The method of claim 41, wherein the deflection wire is anchored at a position that is about 90° relative to the direction that energy is emitted from the transducer to thereby deflect the distal end of the catheter in a direction generally perpendicular to the direction that energy is emitted from the transducer.

43. (Withdrawn) The method of claim 38, wherein the catheter further comprises a tip electrode.

44. (Withdrawn) The method of claim 43, further comprising ablating with the tip electrode before, after or during ablation with the transducer.

45. (Withdrawn) The method of claim 43, wherein the transducer is mounted on a side surface of the tip electrode.

46. (New) The catheter of claim 1, further comprising means for deflecting the distal end of the catheter.

47. (New) The catheter of claim 46, wherein the means for deflecting the distal end of the catheter comprises:

a control handle mounted at the proximal end of the catheter body; and

a deflection wire extending through the catheter body, the deflection wire having a distal end fixedly attached near the catheter body's distal end and a proximal end anchored to a mechanism in the control handle that facilitates longitudinal movement of the deflection wire relative to the catheter body.

48. (New) The catheter of claim 47, wherein the deflection wire is anchored at a position that is about 70° to 120° relative to the direction that energy is emitted from the

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transducer to thereby deflect the distal end of the catheter in a direction generally transverse to the direction that energy is emitted from the transducer.